CLAIMS

1. A pharmaceutical fusion protein composition comprising a fusion protein molecule of a binding protein and an antibody Fc region having complex type N-glycoside-linked sugar chains, wherein the complex type N-glycoside-linked sugar chains have a structure in which fucose is not bound to N-acetylglucosamine in the reducing end in the sugar chains.

2. The fusion protein composition according to claim 1, wherein the complex type N-glycoside-linked sugar chains are sugar chains in which 1-position of fucose is not bound to 6-position of N-acetylglucosamine in the reducing end through α-bond in the sugar chains.

3. The fusion protein composition according to claim 1 or 2, wherein the antibody Fc region is an IgG class of a human antibody.

4. The fusion protein composition according to claim 3, wherein the antibody Fc region is an IgG1 class of a human antibody.

5. The fusion protein composition according to claim 4, wherein the antibody fusion protein composition comprises an IgG1 class heavy chain constant region domain 2 (CH_2) of a human antibody.

6. The fusion protein composition according to claim 5, wherein the fusion protein composition comprises a hinge region, a heavy chain constant region domain 2 (CH_2) and a heavy chain constant region domain 3 (CH_3) of a human IgG1 class antibody.

7. The fusion protein composition according to any one of claims 1 to 6, wherein the binding protein comprises at least one protein selected from the group consisting of a binding fragment of an antibody, a soluble receptor and a ligand protein.

8. The fusion protein composition according to claim 7, wherein the binding fragment of an antibody comprises at least one polypeptide comprising an

antibody heavy chain variable region (VH) and an antibody light chain variable region (VL).

9. The fusion protein composition according to claim 8, wherein the polypeptide comprising an antibody heavy chain variable region (VH) and an antibody light chain variable region (VL) is a single-chain antibody.

10. The fusion protein composition according to claim 7, wherein the binding fragment of an antibody is a single-chain antibody.

11. The fusion protein composition according to claim 7, wherein the binding fragment of an antibody comprises a polypeptide comprising two kinds of antibody heavy chain variable regions (VH) and two kinds of antibody light chain variable regions (VL).

12. The fusion protein composition according to claim 11, wherein the polypeptide comprising antibody heavy chain variable regions (VH) and light chain variable regions (VL) is a single-chain antibody.

13. The fusion protein composition according to claim 7, wherein the binding fragment of an antibody is a bispecific single-chain antibody.

14. The fusion protein composition according to claim 7, wherein the soluble receptor is a soluble TNF (tumor necrosis factor) receptor II.

15. The fusion protein composition according to claim 15, wherein the soluble receptor comprises the amino acid sequence represented by SEQ ID NO:64.

16. The fusion protein composition according to claim 14 or 15, wherein the fusion protein is produced by FERM BP-8499.

17. The fusion protein composition according to claim 7, wherein the ligand protein is LFA-3 (leukocyte function antigen-3).

18. The fusion protein composition according to claim 16, wherein the ligand protein comprises the amino acid sequence represented by SEQ ID NO:65.

19. The fusion protein composition according to claim 17 or 18, wherein the fusion protein is produced by FERM BP-8500.

20. The fusion protein composition according to any one of claims 1 to 19, wherein the fusion protein composition is a dimer.

21. A transformant obtainable by introducing a DNA encoding the fusion protein according to any one of claims 1 to 20 into a host cell.

22. The transformant according to claim 21, wherein the host cell is a cell in which a genome is modified so that an enzyme relating to synthesis of an intracellular sugar nucleotide, GDP-fucose or an enzyme relating to a modification of a sugar chain in which 1-position of fucose is bound to 6-position of N-acetylglucosamine in the reducing end through α-bond in the complex type N-glycoside-linked sugar chain is inactivated.

23. The transformant according to claim 22, wherein the host cell is a cell in which all of alleles on a genome encoding an enzyme relating to synthesis of an intracellular sugar nucleotide, GDP-fucose or an enzyme relating to a modification of a sugar chain in which 1-position of fucose is bound to 6-position of N-acetylglucosamine in the reducing end through α-bond in the complex type N-glycoside-linked sugar chain are knocked out.

24. The transformant according to claim 22 or 23, wherein the enzyme relating to synthesis of an intracellular sugar nucleotide, GDP-fucose, is an enzyme selected from the group consisting of GDP-mannose 4,6-dehydratase (GMD) and GDP-4-keto-6-deoxy-D-mannose 3,5-epimerase (Fx).

25. The transformant according to claim 24, wherein the GDP-mannose 4,6-dehydratase is a protein encoded by a DNA selected from the following (a) or (b):

(a) a DNA comprising the nucleotide sequence represented by SEQ ID NO:1;

(b) a DNA which hybridizes with a DNA consisting of the nucleotide sequence represented by SEQ ID NO:1 under stringent conditions and which encodes a protein having GDP-mannose 4,6-dehydratase activity.

26. The transformant according to claim 24, wherein the GDP-mannose 4,6-dehydratase is a protein selected from the group consisting of the following (a), (b) and (c):

(a) a protein comprising the amino acid sequence represented by SEQ ID NO:2;

(b) a protein consisting of an amino acid sequence wherein one or more amino acid(s) is/are deleted, substituted, inserted and/or added in the amino acid sequence represented by SEQ ID NO:2 and having GDP-mannose 4,6-dehydtratase activity;

(c) a protein consisting of an amino acid sequence which has 80% or more homology to the amino acid sequence represented by SEQ ID NO:2 and having GDP-mannose 4,6-dehydratase activity.

27. The transformant according to claim 24, wherein the GDP-4-keto-6-deoxy-D-mannose 3,5-epimerase is a protein encoded by a DNA selected from the following (a) or (b):

(a) a DNA comprising the nucleotide sequence represented by SEQ ID NO:3;

(b) a DNA which hybridizes with a DNA consisting of the nucleotide sequence represented by SEQ ID NO:3 under stringent conditions and which encodes a protein having GDP-4-keto-6-deoxy-D-mannose 3,5-epimerase activity.

28. The transformant according to claim 24, wherein the GDP-4-keto-6-deoxy-D-mannose 3,5-epimerase activity is a protein selected from the group consisting of the following (a) to (c):

(a) a protein comprising the amino acid sequence represented by SEQ ID NO:4;

(b) a protein consisting of an amino acid sequence wherein one or more amino acid(s) is/are deleted, substituted, inserted and/or added in the amino acid sequence represented by SEQ ID NO:4 and having GDP-4-keto-6-deoxy-D-mannose 3,5-epimerase activity;

(c) a protein consisting of an amino acid sequence which has 80% or more homology to the amino acid sequence represented by SEQ ID NO:4 and having G GDP-4-keto-6-deoxy-D-mannose 3,5-epimerase activity.

29. The transformant according to claim 22 or 23, wherein the enzyme relating to a modification of a sugar chain in which 1-position of fucose is bound to 6-position of N-acetylglucosamine in the reducing end through α-bond in the complex type N-glycoside-linked sugar chain is α1,6-fucosyltransferase.

30. The transformant according to claim 29, wherein the α1,6-fucosyltransferase is a protein encoded by a DNA selected from the group consisting of the following (a) to (d):

(a) a DNA comprising the nucleotide sequence represented by SEQ ID NO:5;

(b) a DNA comprising the nucleotide sequence represented by SEQ ID NO:6;

(c) a DNA which hybridizes with a DNA consisting of the nucleotide sequence represented by SEQ ID NO:5 under stringent conditions and which encodes a protein having α1,6-fucosyltransferase activity;

(d) a DNA which hybridizes with a DNA consisting of the nucleotide sequence represented by SEQ ID NO:6 under stringent conditions and which encodes a protein having α1,6-fucosyltransferase activity.

31. The transformant according to claim 29, wherein the α1,6-fucosyltransferase is a protein selected from the group consisting of the following (a) to (f):

(a) a protein comprising the amino acid sequence represented by SEQ ID NO:7;

(b) a protein comprising the amino acid sequence represented by SEQ ID NO:8;

(c) a protein consisting of an amino acid sequence wherein one or more amino acid(s) is/are deleted, substituted, inserted and/or added in the amino acid sequence represented by SEQ ID NO:7 and having α1,6-fucosyltransferase activity;

(d) a protein consisting of an amino acid sequence wherein one or more amino acid(s) is/are deleted, substituted, inserted and/or added in the amino acid sequence represented by SEQ ID NO:8 and having α1,6-fucosyltransferase activity;

(e) a protein consisting of an amino acid sequence which has 80% or more homology to the amino acid sequence represented by SEQ ID NO:7 and having α1,6-fucosyltransferase activity;

(f) a protein consisting of an amino acid sequence which has 80% or more homology to the amino acid sequence represented by SEQ ID NO:8 and having α1,6-fucosyltransferase activity.

32. The transformant according to any one of claims 21 to 31, wherein the host cell is a cell selected from the group consisting of the following (a) to (h):

(a) a CHO cell derived from Chinese hamster ovary tissue;

(b) a rat myeloma cell line YB2/3HL.P2.G11.16Ag.20 cell;

(c) a mouse myeloma cell line NS0 cell;

(d) a mouse myeloma cell line SP2/0-Ag14 cell;

(e) a BHK cell derived from Syrian hamster kidney tissue;

(f) a human leukemia cell line Namalwa cell;

(g) an embryonic stem cell;

(h) a fertilized egg cell.

33. The transformant according to any one of claims 21 to 32, wherein the transformant is FERM BP-8499.

34. The transformant according to any one of claims 21 to 32, wherein the transformant is FERM BP-8500.

35. A process for producing the fusion protein composition according to any one of claims 1 to 20, which comprises culturing the transformant according to any one of claims 21 to 34 in a medium to form and accumulate the fusion protein composition in the culture, and recovering and purifying the antibody composition from the culture.

36. The antibody fusion protein composition according to any one of claims 1 to 20, which is obtainable by the process according to claim 35.

37. A medicament comprising the fusion protein composition according to any one of claims 1 to 20 and 36 as an active ingredient.

38. An agent for preventing or treating tumor, inflammatory diseases or autoimmune diseases, comprising the fusion protein composition as an active ingredient according to any one of claims 1 to 20 and 36.

39. The agent for preventing or treating the diseases according to claim 38, wherein the tumor is blood tumor or cancer.